



# ***OBSERVATIONS FROM ROOT CAUSE ANALYSIS***

**RAND in Support of PARCA**

**May 2012**

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NPS Acquisition Symposium**

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# ***Performing Root Cause Analysis***

- **Others have/will cover the enabling legislation, PARCA duties and responsibilities and relationships**
- **Characteristics of effort**
  - **Be factual**
  - **Be concise**
  - **Be timely**
- **Requires a multi-disciplinary approach**

# *Analytical Approaches*

- Sodium pentothal
- Torture
- What did people say happened (anecdotal)
- Facts from various sources



Just the facts, mam.  
Just the facts.



**Consistent with the Express Direction From  
PARCA We Went with Facts.**

# ***“Just the Facts”***

- **Voluminous amount of material**
  - **Acquisition databases**
  - **Budgetary exhibits and justification material**
  - **Congressional testimony**
  - **Open sources**
  - **Interviews**
- **Mix of classified, proprietary, business sensitive and other data**
- **Reconciliation is sometimes required.**

# ***Analyses Performed***

- **Root Cause Analyses (both Nunn-McCurdy breaches and others)**
  - **AB3; Longbow Apache**
  - **DDG-1000; Zumwalt-Class Destroyer**
  - **Joint Strike Fighter (with Univ. Tenn. & IDA)**
  - **Wideband Global Satellite**
  - **Navy ERP**
  - **Excalibur**
  - **JTRS-GMR**
  - **P8 Aircraft**
  - **EELV**
- **Over twenty professional staff applied to this group of program analyses**

# ***Root Cause Related***

- **Examination of Management Issues**
  - **Nunn-McCurdy Repeaters**
  - **Nunn-McCurdy Predictions**
  - **Program Manager Tenure**
  - **WSARA Law related to Mil Departments**
  - **Root Cause Knowledge Management**
  - **Root Cause Global Hawk Modifications**
  - **Root Cause Framing**

**Our Perspectives Are Informed By Both**

# Program Differences

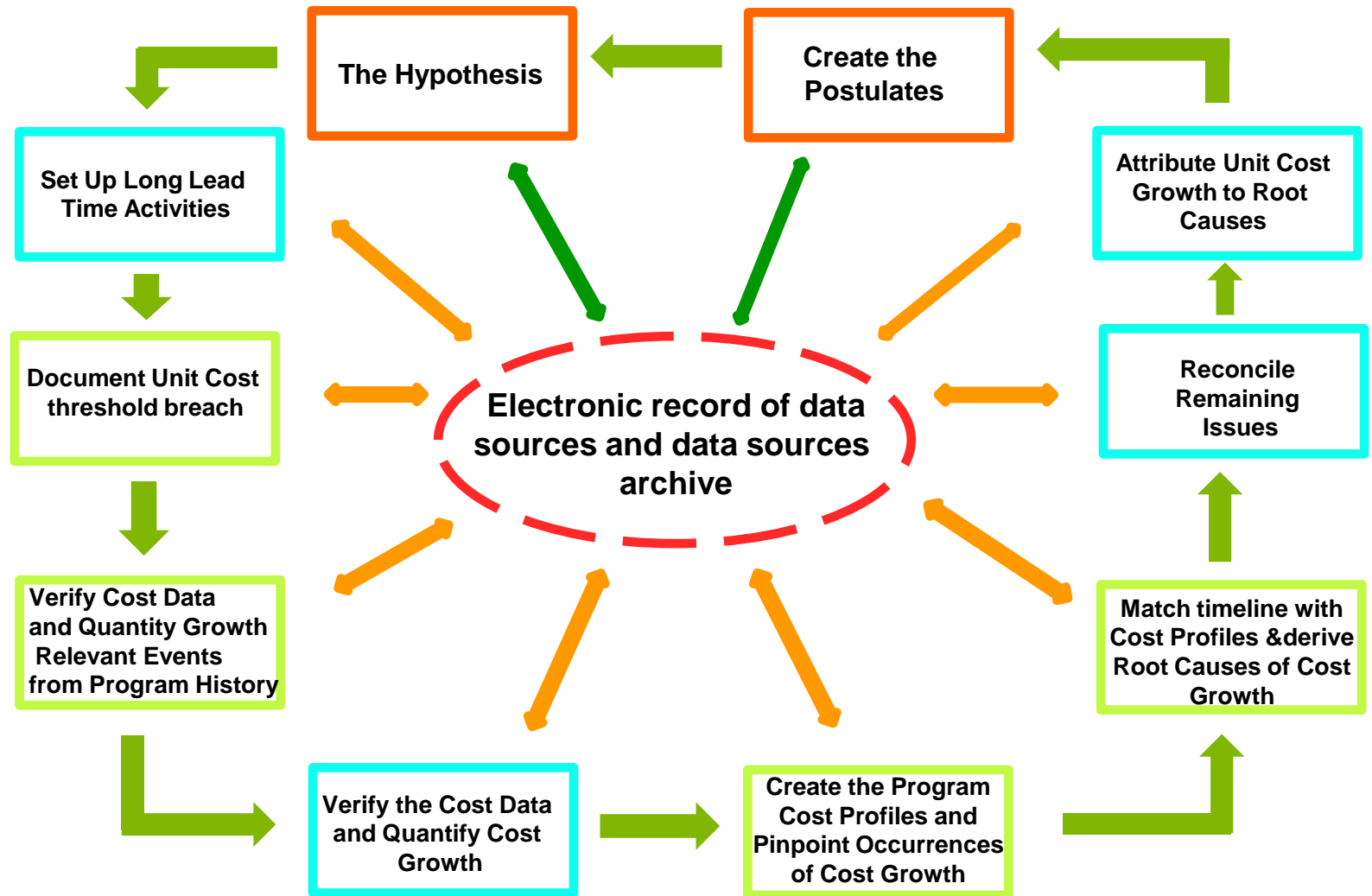
- Each of the programs analyzed was different (Kendall's point on program structure)
- But some common issues pertain

|                    | Category          | Root Cause of Nunn-McCurdy Breach                                     | Apache | DDG-1000 | ERP | Excalibur | JSF | WGS | JTRS GMR |
|--------------------|-------------------|---|--------|----------|-----|-----------|-----|-----|----------|
| Within DoD Control | Planning          | Underestimate of baseline cost  | ✓      | ✓        | ✓✓  |           | ✓   | ✓   |          |
|                    |                   | Ambitious scheduling estimates  |        | ✓        | ✓   | ✓         | ✓   |     | ✓        |
|                    |                   | Poorly constructed contractual incentives                             |        |          | ✓✓  |           | ✓   | ✓✓  |          |
|                    |                   | Immature technologies   | ✓✓     | ✓        |     | ✓         | ✓✓  |     | ✓✓       |
|                    |                   | Ill-conceived manufacturing processes                                 |        | ✓        |     |           |     |     |          |
|                    |                   | Unrealistic performance expectations                                  |        | ✓        | ✓   |           |     |     | ✓✓       |
|                    |                   | Delay in awarding contract  |        | ✓        |     |           |     |     |          |
|                    |                   | Insufficient RDT&E  | ✓      | ✓        |     |           | ✓   | ✓   |          |
|                    | Program Oversight | Production delays   |        | ✓        |     | ✓         | ✓✓  | ✓✓  | ✓        |
|                    |                   | Change in procurement quantities                                      |        |          |     |           |     |     |          |
|                    |                   | Increase  | ✓✓     |          |     |           |     | ✓   |          |
|                    |                   | Decrease  |        | ✓✓       | ✓   | ✓✓        | ✓   |     | ✓✓       |
|                    |                   | Unanticipated design, manufacturing, or technology integration issues | ✓✓     | ✓        | ✓   | ✓✓        | ✓✓  |     | ✓✓       |
|                    |                   | Lack of government oversight and/or poor performance by contractor    |        | ✓        |     | ✓         | ✓   |     |          |

- Approach has to be flexible to cover the differing program characteristics and issues involved



# ***RAND Uses an Iterative Approach to Root Cause Analysis (RCA)***



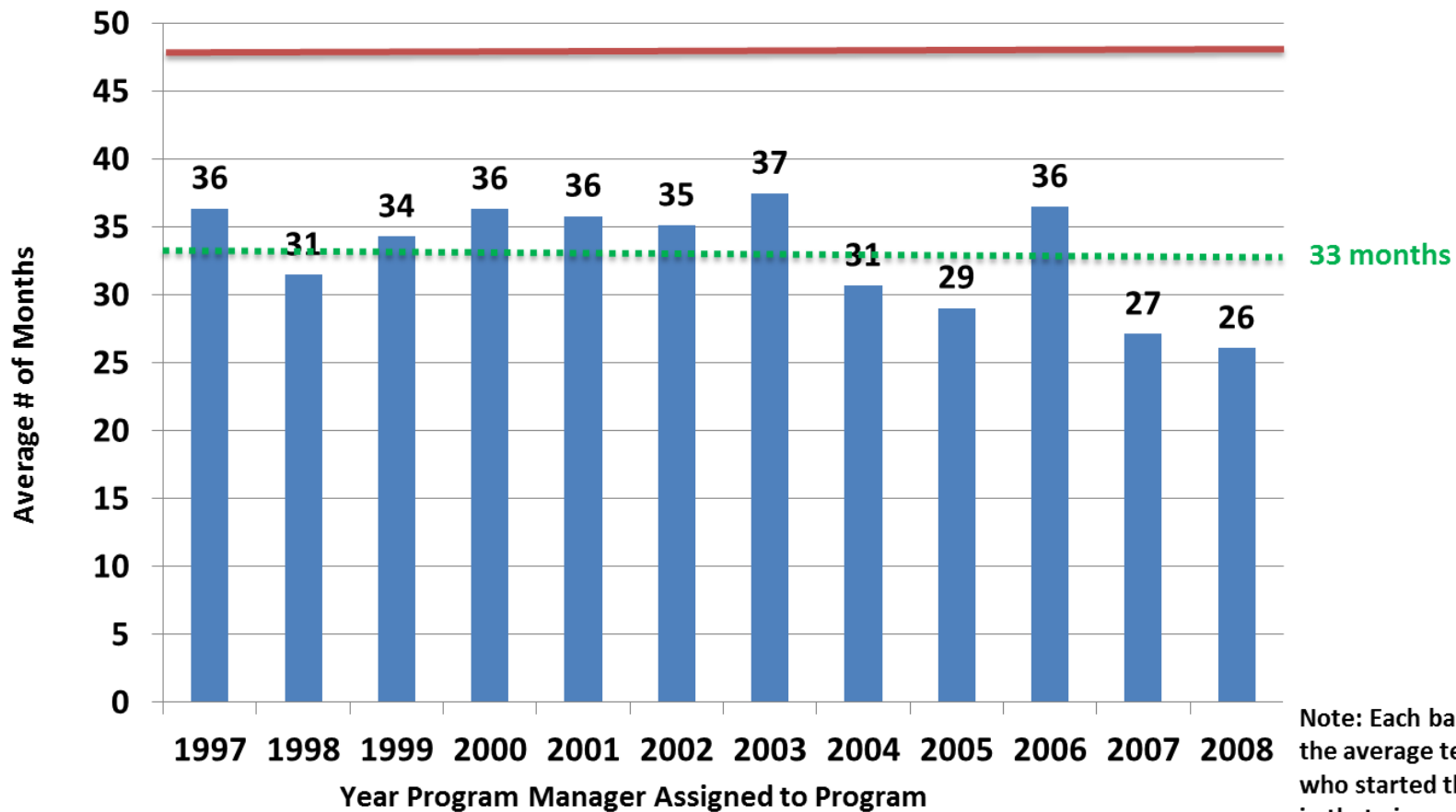
# ***RAND Important Perspectives From RCA***

- **Several lessons stand out**
  - **Need to understand the interrelationship of major modernization programs (FCS)**
  - **Revolving program management is the antithesis of program stability (F-35)**
  - **If a program depends upon a commercial base, keep an eye on that base (WGS)**
  - **For ERPs, distinguish between IT software and business re-engineering as an IT program**
- **Need to go beyond metrics used generally in acquisition program oversight**

# ***Interesting Issues Identified in the Process of Both RCA and Management Questions***

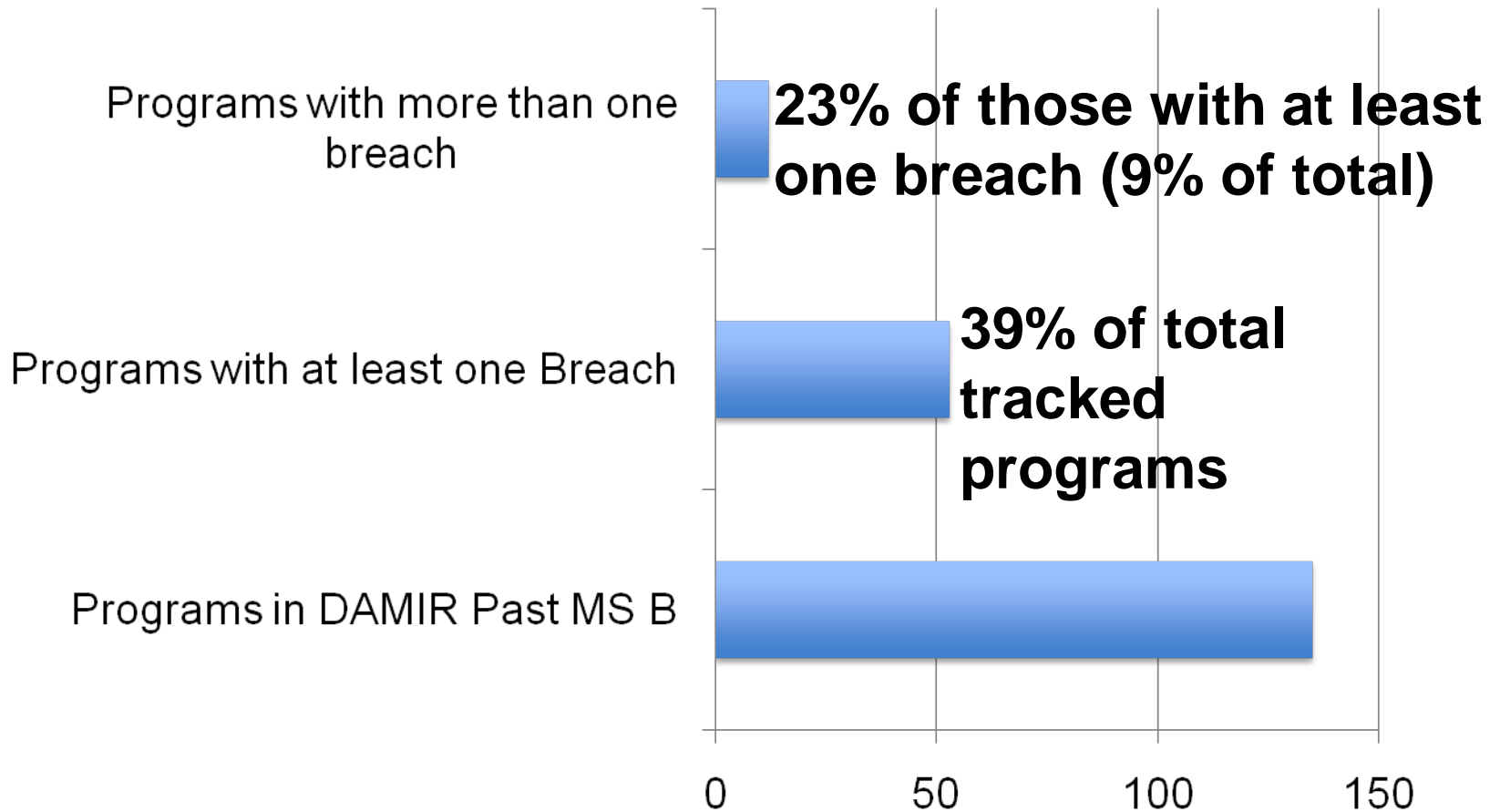
- **PM Tenure**
  - Not identified as a Root Cause
  - An examination across all MDAPs suggest an average of close to 3 years
  - Average tenure is sensitive to calculation methodology
- **Financial Stability**
  - For major programs resource decisions were driven, not driving
- **Multiple Breaches**
  - No single reason between programs and across individual program multiple breaches
- **Framing Assumptions (Examples)**
  - Understanding risk
  - COTS/commercial base
  - Use of simulation

# *Program Manager Tenure*



Note: Each bar represents the average tenure of PMs who started their assignment in that given year.

# ***Populations Demographics (based on DAMIR since 1997)***



# ***Definition and Examples of “Framing Assumptions”***

- **Framing assumption definition:** *Any explicit or implicit assumptions that are central in shaping cost, schedule, and/or performance expectations*
- **Unique to a program; not universal to all programs**

| <b>A framing assumption is...</b>                                       | <b>A framing assumption is not...</b>            |
|---|--|
| A unique aspect of contracting strategy (e.g., competitive prototyping) | The contractor will perform well                 |
| Weapon system to be replaced will last until a specified time           | Program characteristic (e.g., family of systems) |
| Use of COTS / GOTS will save money                                      | Program is affordable                            |

# Back up



# Identified Framing Assumptions of Past RCAs

| Technical   | Management/Program Structures  | Mission Requirements   |
|---|--|--|
| Reliance on commercial technology increases likelihood of achieving technical program goals. (P-8A, WGS, ERP) | Reliance on commercial initiative/standards insulates the program from risk. (P-8A, WGS, ERP)              | Low possibility for emergence of a substitute good. (JTRS)   |
| Successful sub-system testing predicts overall technical program success. (JSF, Excalibur, AB3, DDG1000)      | Threats to program funding are an incentive to manage program risk. (ERP, DG1000, JSF).                    | Constancy with joint capability requirements (JSF)   |
| Simulations can substitute for or reduce full scale testing. (JTRS, JSF)                                      | Management changes do not detract from program outlook. (JTRS, JSF)  | Reliance on commercial technology shields program allows program to adapt quicker to changing operational requirements. (P-8A) |
| New testing/manufacturing approaches can reduce historic number of test articles (JTRS, JSF, P-8A)            | Program sub-component/integration risks not a geometric risk function (JSF, AB3, DDG1000, JTRS, Excalibur) |  |



# ***Apache Breach Root Cause***

- **Root Cause**
  - **Quantity increase**
    - **58 new build aircraft (100% new) added to retrofit program (30% new)**
    - **Buy new fuselages; unavailability of airframes**
- **Major Contributors**
  - **Immature technologies**
    - **Incorporate 15 cutting edge technologies**
  - **Unanticipated design, manufacturing, or technology integration issues**
    - **Increase in non-recurring engineering costs to reflect post MS B knowledge & experience**



# ***DDG-1000 Breach Root Cause***

- **Root Cause**
  - **Quantity decrease**
    - **Reduction from 10 ships at MS B to 3 ships due to affordability issues**
- **Major Contributor**
  - **7 program planning issues contributed to cost growth**
  - **None were significant individually, but collectively may have been significant**
    - **Underestimation of baseline cost**
    - **Ambitious schedule**
    - **Immature technologies**
    - **Ill-conceived manufacturing process**



# ***JSF Breach Root Cause***

- **Root Cause:**
  - **Numerous Immature technologies**
    - **Complex integration**
    - **Reliance on unproven innovations to contain program costs**
    - **Prototype did not demonstrate new technologies**
- **Major Contributors:**
  - **Production delays**
    - **Aggressive and highly concurrent schedule**
    - **Affordability required fast ramp to high production rates**
  - **Unanticipated design, manufacturing, and technology integration issues, including weight growth and design issues**



# ***Excalibur Breach Root Cause***

- **Root Cause:**
  - **Quantity decrease**
    - **Reduction from 30K to 7K projectiles due to affordability and lack of customer demand**
- **Major Contributor:**
  - **Unanticipated design, manufacturing, or technology integration issues**
    - **Early program cost estimates highly inaccurate and insensitive to reductions in quantity**



# ***WGS Breach Root Cause***

- **Root Cause:**
  - **Production delays**
    - **2.5 year hiatus between Blocks II and III**
    - **Options allowed to expire; multi-year procurement breaks**
    - **Storage and restart costs**
- **Major Contributors:**
  - **Increase in component costs**
    - **Commercial marketplace no longer supports WGS systems which have not changed in 10 years**
  - **Poorly constructed contractual incentives**
    - **15% risk premium with limited evidence of risk**



# ***JTRS GMR Breach Root Cause***

- **Root Cause:**

- **Quantity fell from 86K to 10K radios**
  - **Cancellation of FCS**
  - **Performance issues which reduced the size of the WNW network**
  - **Emergence of lower cost, lower SWAP alternatives**



- **Major Contributors:**

- **Immature technologies & unrealistic performance expectations**
  - **“Mobile ad hoc networks” scalability up to 250 nodes assumed, but field experiments only achieved a 30 node network size**
- **Unanticipated design issues**
  - **Demonstrated limitations on network size required a redesign of the network architecture, which employed fewer GMRs**

# ***Most of the Significant Root Causes Are Within DoD Control***

- **Planning and program oversight issues – which are within DoD’s control – are significant root causes of cost growth**
  - **5 of 7 RAND analyses identify planning issues**
  - **All 7 RAND analyses identify program oversight issues**
- **Only one program (WGS) showed economic issues as a significant root cause of cost growth**
- **Related root causes can be collectively significant**
  - **7 planning issues in DDG case contributed to cost growth though no single planning issue was a significant root cause**

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